JOURNAL

OF THE

New York Entomological Society.

Vol. X. MARCH, 1902. No. 1.

CONTRIBUTIONS TO THE KNOWLEDGE OF NORTH AMERICAN ARCTIIDÆ, I–II.

(Plates I and II.)

By Otto Seifert.

Arctia arge *Drury.*

In the neighborhood of New York city, on dry, sunny hillsides and scanty pastures under loose stones and rubbish, two kinds of *Arctia* caterpillars may be found in numbers late in fall and again early in spring before the new vegetation has made much progress.

One of these, hibernating most frequently nearly full grown, is the grayish-brown, long-haired larva of *Arctia arge;* its flesh colored dorsal, subdorsal and infrastigmatal angular band, as well as the pale, long rather soft vestiture distinguishes the larva easily from all others which may be found under the same circumstances. All the *arge* larvæ have the stripes distinct and plain, mostly flesh-colored, less frequently cream-colored or variegated with reddish spots; the ground color of body varies from dark gray to brown, always with darker patch-like shades.

The moth appears during the latter part of April and is common in the beginning of May; contrary to most of its relations the female of *arge* deposits her eggs in regularly arranged masses from 25 to more than 200 securely fastened to the underside of a leaf of one of the numerous food plants or in a rather uniform broad ring around the withered branchlet of an aster or a decayed flower-stem. The white color of the eggs, when exposed in this way, correspond with the objects they are attached to. The shape of the eggs as well as the

reticulations are nearly the same as of most of the *Arctia* but are decidedly more rounded at the apex. Newly deposited they are maize-colored, turn quickly opaque white and by degrees change from pale pink to lilac and at last to dull slate. The micropyle as a dark spot is plainly indicated very soon after the egg is laid. The larva and its early stages are well known; the egg-state lasts 9 to 10 days, the larval period at least 38 days and the imago will appear after not less than 12 days of pupal rest. A large number of the individuals of a brood follow this rule, but as with most of their related species the irregularity in the development of the same progeny is obvious. Larvæ of the same brood may yet be feeding, while imagines are already at large; hence a continuous propagation takes place and the moths as well as the larvæ are present from early spring to rather late in fall, so that exposed females readily find mates at any time provided the species occurs in the vicinity.

Arctia arge exposed and found mated near New York city, 2, v. 11, v. 29, v. 4, vii. 16, vii. 17, viii. 23, viii. 30, ix.

Arctia nais, exposed and found mated near New York city, 14, v. 17, v. 19, v. 31, v. 8, vi. 6, vii. 26, vii. 10, viii, 4, ix. 22, ix. 1, x.

The pupa, compared with those of the group *Apantesis* Wlk. (Dyar, Revis. N. A. Bombyces) is more raised on first abdominal segments; the cremaster terminating in a blunt, furrowed, jointed spine with short, knobbed hooks around the end, to which the empty larval skin tenaciously adheres. The variability of the imagines is limited to a more or less extension of the pinkish cream-colored bands on primaries and the number, size and intensity of the black spots on secondaries and more restricted to the females, the variegated attempts of the pink and salmon-red shades to extend and intensify. The black abdominal spots are also liable to change in size, but are very rarely confluent to bands (female) ventrally. This is the case, though with a melanotic form (male), where the black of primaries is very intense and prevailing, the cream color limited to the veins only; the secondaries are smoky black, deepest and almost forming a broad band on outer margin diminishing towards the base of wing, the triangular discal spot well defined but narrow. The under side uniformly dusky, blackish with fine pale veins, costal margin deep red.

Freshly formed pupæ exposed to a temperature of about + 38° C. (100° F.) for 100 hours gave after six days, male imagines with the

black color on primaries much reduced, the pale bands aiming to unite, bands 2 and 3 often confluent forming with the broad longitudinal bands a large median patch; the black maculation on hind wings mostly reduced to mere dots. The black dorsal spots on abdomen greatly obliterated often only the two faint last ones present; ventrally and laterally the spots diminished likewise. Apparently nothing was gained by the experiment but an extreme southern form of *arge*. The females thus obtained deviate from the males in the same manner as if normally developed. The males striving to simplify their coloration, while the females, though widening the pale bands also but more reluctantly, at the same time intensify their colors; the black on fore and hind wings turning deeper and brighter and the salmon red of secondaries spreading and deepening.

Freshly formed pupæ exposed to + 4° C. (38° F.) for thirty days or more, and at once or gradually transferred to normal temperature gave imagines according to the retarding process in about ten days.

All the moths thus obtained have the black on primaries intensified but rarely more extended than with many of the normal forms, but the secondaries are changed in a remarkable degree. The black maculation is enlarged but paler and a dusky or blackish hue cast over the whitish (♂) or reddish (♀) color. Contrary to the melanotic form (Standfuss, Handbook), where the darkening process commences from outer margin, the black in the forms by cold is spreading radiate from the base of the wing towards outer margin. Below, basal and median part of wings much obscured by blackish shade.

The black abdominal spots are confluent to bands ventrally and with some individuals even laterally and dorsally. Even by exposing the pupæ to a temperature far below the freezing point for about 24 hours the results were practically the same.

Among the number of specimens thus obtained many attain superficially a resemblance to *Arctia quenselii* Payk.

The rearing of progenies of thus changed parents to confirm the transmission of acquired characters (Standfuss, Iris, xii, 1899), have on account of the difficulty in raising the offspring of thus manipulated parents been unsuccessful; the larvæ could not be carried beyond 4th moult.

A female changed in the above manner by cold, was exposed August 10th (Long Island) and found with a typical male next morning. The brood obtained was a very sensitive one. Part of the

pupæ were again transferred to ice, the remaining ones left to normal development; these latter rendered only two perfect imagines, male and female. The primaries of the male have the black color above not more produced than some of the darker varieties of the regular forms; the hind wings are more pinkish than white, somewhat diaphanous with numerous maculations. Below the resemblance to the aberrative female parent is plain, not only have the primaries a dusky shade spreading from the root of the wing towards median space, obscuring the pale color, but the two rows of ventral spots are also confluent into broad bands. The female has the dusky shade below also, but in a less degree and with large normal broods females are always found with a similar dusky shade; the lateral and ventral abdominal spots unite to broad bands leaving only a narrow median line connected with the limited transverse lines between the black bands. Those pupæ retarded by cold rendered imagines behind the normal size, the abdomen with all of them banded ventrally, primaries not materially changed but the black color more prevailing than in normal forms, hind wings even with males pale pinkish, subdiaphanous with profuse maculations. Below, the black of primaries mostly dominant, the pale bands greatly reduced.

EXPLANATION OF PLATE I.

Fig. 1. Normal male.
Fig. 2. Normal female.
Fig. 3. Male; pupa exposed to + 35 to 42° C. from July 4–10; imago, July 13.
Fig. 4. " " " " " " 100 hours; imago, July 15.
Fig. 5. Female; " " " " " " " July 16.
Fig. 6. " " " " " " " June 20–27; imago June 30.
Fig. 7. Male; pupa on ice, July 30–August 1; imago, August 13.
Fig. 8. Female; " " " " " August 11.
Fig. 9. Male; " " " " " " August 13.
Fig. 10. Female; " June 23–July 21. + 14° C July 21–August 10. + 22° C. until imago, August 18.
Fig. 11. Female, pupa on ice for 7 weeks.
Fig. 12. ♂ Melanotic form. Larva collected. Nov.; reared on *Cichorium endivia*. Imago January 13.

Arctia nais *Drury*.

The species of the group *Apantesis* Wlk. (Dyar, Revision of Bombyces), besides many other congenial qualities, show a most indifferent, careless way in distributing their eggs. They may be deposited

in irregular patches on the undersides of leaves which the larvæ never will touch (eggs of *A. vittata* on underside of leaf of *Ailanthus glandulosa* shoot), on pieces of wood, paper and other objects or are scattered or in clusters on the bare ground. The eggs are not fastened tightly, but are easily removed.

Though all Arctiidæ are more or less polyphagous, the forms belonging to this group are inclined to prefer *Taraxacum* and *Plantago major* to any other herb. The color of the eggs of all the species is yellowish-white or pale straw color, rather bright with fine reticulations, with naked eye they appear smooth; they have the shape of blunt cones with shallow bases. The width of the eggs of *nais* at base is about 0.7 mm. and from vertex to base 0.6 mm. A sound, normal female deposits at least 500 eggs. Of the three species occurring in the vicinity of New York City, *A. nais* prefers the dry, scanty hillsides and pastures; *A. phalerata* meadows, even damp ones, where on sunny fall days the larvæ may be found basking in the morning sun on the branchlets of asters, etc.; *A. vittata* seems to be more inclined to frequent the grassy borders of woods, or rich forest lawns and meadows.

Arctia nais, on account of its habits, is the most common species near New York. The larva in all its stages has been described by G. H. French (Papilio, II, p. 179), but when reared in large numbers and of different broods the variability of the larvæ is striking, and in some individuals where the typical pale dorsal band is obscured or entirely obliterated, they can not be distinguished with certainty from some of the varieties of the other species.

To obtain some information about the variations of *A. nais* and its larva, numerous broods were reared from May to September and even during winter. (Eggs obtained December 3d and 4th, imagines from March 17th; larvæ fed with cultivated *Cichorium endivia*.)

The larvæ after fourth moult attain in general their specific brown to blackish color, the dorsal stripe often obscured but traceable. Achieving after sixth moult their maturity, they vary from yellowish-brown to dull walnut, and from rich seal-brown to velvety black. The dorsal stripe changes with individuals of the same brood from dusky white to nankeen and flesh-color to reddish. The stripe is often obscured on the thoracic and the terminal segments, sometimes only observable on the anterior of segments or not traceable at all. The color of the bristles varies according to the ground color, but those directed from

anterior warts of first segment partly over the head of the larva, and all the bristles directed downward from stigmatal warts and below are much paler and vary from brownish-gray to rust-red. In general the deeper and more intense the color of the larva, the more obsolete the dorsal stripe and the brighter the reddish bristles.

The shortest duration from depositing of the eggs to the imago state under the same thermal conditions and maintenance varies from 48 to 58 days.

4 ♀ ♀ exposed May 15.
Eggs depos. May 16, 17, 18,
" commence to hatch May 23.
Larvæ commence to pupate June 24.
Imagines appear July 4.
The majority July 10–12.
Many larvæ still feeding, July 30.
Duration 49 days.

♀ exposed May 17.
Eggs depos. May 19 to 27.
" hatch May 29 to June 7.
First pupæ July 7.
" imagines July 17.
Majority until July 22.
some larvæ still feeding.
Duration 58 days.

♀ exposed May 29.
Eggs depos. May 30.
" hatch June 5, 6, 7.
First pupæ July 4.
" imagines July 17.
♀ exposed June 7.
Eggs depos. June 8.
Imagines appear July 2.
Duration 48 resp. 54 days.

In forming their cocoons the larvæ show a similar indifference as the females do in depositing their eggs. As a rule the larva spins an ample loose cocoon and sometimes more than one caterpillar try to find shelter within a forming one; often the pupa is simply hidden in the fold of a large leaf or directly exposed on the ground. Generally the pupæ have a bluish bloom cast over them but often this bloom is entirely lacking; with many the reddish-brown incisions on movable segments do not darken but remain reddish-brown. Mostly the empty larval skin will adhere to the minute discs or buttons with which the diverging bristles on cremaster are crowned.

The remarkable variability of the imagines in both sexes of this flexible and pliant species, is nevertheless bound to certain limits. The characters inclined to variation are with all the species of the *Apantesis* group the same, only does every species aim at another ideal and consequently the majority of its individuals develop in a direction different from those of the other species. The females of all the forms of this group seem to be far more conservative than the males. The animation or stimulus to variation and its direction seems solely to rest with the parents. Notwithstanding the comprehensive and convincing experiments of Standfuss (Handbook) and others to the contrary many entomologists still maintain that the food-plant might be cause

of variability of a species. A trial in this respect was made with one generation of *nais*, though evidently the food-plant could be of no concern to such a polyphagous species.

Four females, all with red hind wings, were exposed May 17th and 18th in Long Island and Westchester Co. One part of the newly-hatched larvæ were reared solely on *Taraxacum* and *Plantago;* another part was fed on *Rumex acetosella* and the remaining third on *Artemisia absynthium*. The result was that those larvæ reared on *Taraxacum* and *Plantago* developed in the most satisfactory manner, the imagines including all varieties in perfect examples; while the part raised on *Rumex acetosella* gave also the varieties in the same proportion as the first part, but every one of the number behind the regular size and of sickly appearance; those fed on *Artemisia absynthium* all died before pupating.

In *A. nais* male and female the costal margin is always black and even with the varieties which have the ≷ mark most complete, this latter never impairs the black costal margin. The subcostal and submedian longitudinal stripes are in both sexes often much reduced, the former sometimes not reaching transverse posterior band, the latter forming a fork with the median longitudinal band, which always reaches to transverse posterior stripe.

The males of *nais* have pale ochre yellow secondaries, often more or less tinged with reddish, the red color always originating from root of wing, streak-like, most profuse generally near abdominal margin. Originally perhaps the hind wings of the male had a black marginal band, as many of the females have now, but with the many hundreds reared under normal conditions and seen elsewhere in collections, this band is always dissolved into spots, often reduced to dots and sometimes obliterated altogether except one large, black apical spot attached to the costal black shade. Comparing a large series of both males and females, the breaking of the marginal band seems to originate right below apex by the fork-like inroad of the ground color, separating at first the band in three unequal parts; the thus acquired character may be aggravated by transmission.

The females either have deep ochre-yellow or red hind wings, sometimes, but not frequently suffused; they are either bordered by a black marginal band or this is broken into three or more prominent spots of unequal sizes. The band is nearly always, though often very slightly, inverted below apex, the ochre or red color forming a tooth-

like indention, which traced through a series of specimens gets forked and finally separates the band into three parts. This reduction of the marginal band into spots is always accompanied by the development of the ≒ mark on primaries, so that not an intimation of the ≒ mark exists where the black marginal band is most complete and it is generally most developed when the band is broken into nearly two rows of spots. The band or its fragments rarely interfere with the discal spot and the color of the hind wings is altogether independent from the markings.

How important a factor the transmission of parental characters is in respect with the variability the trials will show; unfortunately not always the male could be secured with the exposed female, but as copulation within the same progeny was undesirable this could not be overcome.

♀ exposed May 28th.
≒ mark narrow but distinct.
Secondaries reddish; black marginal band partly broken up into spots.
♂ not obtained.
105 perfect specimens examined.
♂ ♂ 47. ♀ ♀ 58.
♂ ♂ with ≒ mark or indication of it: 39.
♂ ♂ entirely without ≒ mark: 8.
♀ ♀ with ≒ mark or indications: 32.
♀ ♀ entirely without ≒ mark 26.
♀ ♀ with yellow hind wings, none.

♀ exposed June 8th.
♀ with yellow hind wings and without ≒ mark on primaries.
♂ with broad ≒ mark and faint reddish tint on secondaries near root of wing.
Marginal spots of secondaries much reduced.
113 perfect specimens examined.
♂ ♂ 63. ♀ ♀ 50.
The whole offspring with yellow hind wings.
♂ ♂ with ≒ mark 47.
♂ ♂ without ≒ mark 16.
♀ ♀ with ≒ mark 11.
♀ ♀ without ≒ mark 39.

♀ exposed May 14th.
♀ without ≒ mark on primaries.
Secondaries red with black marginal band.
♂ with very plain ≒ mark, hind wings without reddish tint.
200 specimens examined.
♂ ♂ 78. ♀ ♀ 122.
♂ ♂ with ≒ mark 23.
♂ ♂ without ≒ mark 55.
♀ ♀ with ≒ mark 4.
Two of these with red and two with yellow hind wings.
♀ ♀ without ≒ mark and red hind wings 118.
♀ ♀ without ≒ mark and yellow secondaries 20.
All the ♀ ♀ of this brood with black marginal band, except the four with ≒ mark.

♀ exposed May 14th.
♀ with red hind wings and distinct ≒ mark on primaries.
♂ not examined.
150 specimens examined.
♂ ♂ 75. ♀ ♀ 75.
♂ ♂ with ≒ mark 75.
♀ ♀ with ≒ mark 75.
♀ ♀ with red secondaries 35.
♀ ♀ with yellow secondaries 40.

The broods derived from females exposed May 14th have been reared under normal conditions; the individuals of each of the other two were partly submitted to high or low temperature.

A temperature of + 40° C. for 100 hours or + 4° C. for 30 to 40 days had the peculiar effect on newly formed pupæ of *nais* to produce asymmetrical results in regard to primaries and secondaries irrespective of sex, but more pronounced with females. Heat as well as cold caused a tendency to expand the longitudinal and mostly always present but rudimentary transverse posterior stripes on primaries often to such an extent as to leave only two limited streaks of black color above and below median band, never impairing though the black costal margin or spreading practically beyond transverse posterior stripe.

Heat affects the secondaries of the males by a reduction of the black maculation, whilst the pale ochre color turns lighter but brighter. The discal spot weak but mostly as in the normal forms present. With the females heat reduces the black marginal band or maculation perceptibly and intensifies the color, animating the vital activity even so far as to produce ultimately true melanotic forms.

Exposure to low temperature, with both sexes, enlarges the black maculation or marginal band decidedly, often even with the males uniting the black spots to an irregular band, the black color losing though much of its deepness.

The red or yellow color of the hind wings is not dependent on thermal conditions and the inclination to melanism seems to be confined to the female forms with yellow hind wings.

The larvæ of *A. nais* and related species are often infested by a dipterous parasite, *Thelaira leucozona* Panz., which fastens its eggs mostly on the head of the larva. Wintering larvæ not carefully attended to are subject to muscardine to an alarming extent.

EXPLANATION OF PLATE II.

Fig. 1. *Arctia nais*, male; found in copula with exposed ♀, June 8.
Fig. 2. " " " imago, June.
Fig. 3. " " " " July.
Fig. 4. " " " " July.
Fig. 5. " " female; " July.
Fig. 6. " " " " May.
Fig. 7. " " " " December; reared on *Cichorium endivia*.
Fig. 8. " " " " " " " " " " "
Fig. 9. " " " " " " " " " " " "
Fig. 10. " " male; pupa on ice, July 10 to August 10; imago, Aug. 19
Fig. 11. " " " " " July 20 to August 20; " " 30

Fig. 12. *Arctia nais*, male; pupa on ice, July 10 to August 10; imago, Aug. 27
Fig. 13. " " " " " " 8 to " 14; " " 25
Fig. 14. " " female; " " " 7 to " 14; " " 24
Fig. 15. " " " " " " 8 to " 14; " " 25
Fig. 16. " " " " " " 7 to " 14; " " 24
Fig. 17. " " " " " " 7 to " 24; " " 31
Fig. 18. " " female; pupa exposed to + 35–+ 42°C., from July 21–26; imago, July 30. Melanotic form.

Fig. 19. *Arctia nais*, male; pupa exposed to 35–+ 42° C., July 23–July 26; imago, August 1.

Fig. 20. *Arctia nais*, male; pupa exposed to 35– + 42° C., July 20–July 25; imago, July 29.

Fig. 21. *Arctia nais*, male; pupa exposed to 35– + 42° C., July 20–July 25; imago, July 29.

Fig. 22. *Arctia nais*, male; pupa exposed to 35– + 42° C., July 20–July 25; imago, July 30.

Fig. 23. *Arctia nais*, male; pupa exposed to 35– + 42° C., July 20–July 25; imago, July 29.

Fig. 24. *Arctia nais*, male; pupa exposed to 35– + 42° C., July 20–July 25; imago, July 31.

LIFE-HISTORY OF AËDES SMITHII *COQ.*

BY JOHN B. SMITH, SC.D.

As Dr. Harrison G. Dyar has described and figured the larva of this species in the last number of this JOURNAL (Vol. IX, p. 178), I will not again rehearse the characters given by him.

My first acquaintance with the insect began in late November, 1900, when Mr. J. Turner Brakeley called my attention to the fact that, in the pitcher plants in the swamps surrounding his cranberry bogs at Lahaway, there were what he thought mosquito larvæ. The matter did not interest me very strongly at the time. I verified the fact that they were mosquito larvæ and, because that species was common about there, I assumed that it was *pungens*. Dr. Howard's pamphlet on mosquitoes had been not long since published, and the larvæ in the leaves of the plant fitted to his pictures and description sufficiently well. As *Culex pungens* breeds everywhere, it did not strike me as especially odd that the larva should be in the leaf pitchers, and I assumed that they were, probably, present in the bog holes and ditches as well.

In reply to the question, what will become of these larvæ, I informed Mr. Brakeley that *Culex pungens* hibernated as an adult; that the larvæ are dependent upon atmospheric air and that these specimens